Energy and Momentum

1. A boy of mass 60kg and a girl of mass 40kg are skating partners. They stand together in the middle of a rink and push each other away. In doing so, the girl obtains a momentum of 32kg m/s [East].
2. What is the momentum of the boy at that point?
3. What is the velocity of the girl at that point?
4. What is the velocity of the boy at that point?
5. Which of Newton’s laws of motion does this particular situation demonstrate?
6. A spring scale is marked 0N to 10N. The distance from the 0N mark to the 10N mark is 6cm. What is the spring constant of the spring?
7. A rubber ball of mass 250g is thrown against a wall at a speed of 13m/s.
8. Assuming this is a perfectly elastic collision, find the change in momentum of the ball.
9. If this occurs within a timespan of 10ms, find the force on the ball during the collision.
10. A 24kg grocery cart is pushed away at a speed of2.6m/s towards the return dock, which is only 13m away along a level floor. The cart’s wheel bearings exert a frictional force of 7N in total, slowing the cart down as it rolls. Will the cart have enough energy to make it to the dock?
11. A bungee jumper is attached to a cord 20m in length. The cord has a spring constant of 96N/m. What is reasonable safe height to jump from?
12. A firecracker of mass 18g explodes into three pieces of equal mass. The first piece flies off at a speed of 24m/s. The second piece flies at 18m/s at an angle 110o from the direction of the first piece. Find the speed and direction of the third piece.
13. A bee of mass 2.5g is traveling at 6.00m/s along a road when it strikes a motorcyclist coming the other way at 44.0m/s. The bee ends up attached to the biker’s helmet in a totally inelastic collision. If the biker’s head and helmet had a combined mass of 6.000kg (pre-collision) find:
14. the change in speed of the biker’s head.
15. The force (whiplash) felt by the biker if the collision occurs over 10ms.
16. A young girl runs with a kite. The kite pulls with a constant force of 34N. How much work must she do to pull the kite a distance of 10m if the kite is pulling at an angle of:
17. 35o from the horizontal.
18. 70o from the horizontal.
19. A billiard ball of mass m travels at 20cm/s[Fwd] along a table. At the same time a second ball of equal mass is on collision course traveling at 30cm/s [Fwd 20o Left]. They meet in a collision, and the first ball veers off with velocity 24m/s [Fwd 50o Left] . What is the speed and direction of the second ball?